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ABSTRACT

The efficacy of teaching the pronunciation of English polysyllables to non-native speakers by means of ordered rules which use standard orthographic representations as underlying forms was tested on two groups consisting mainly of francophones. The experimental group applied ordered quasi-phonological rules to selected words from each of fifteen word classes being tested. The control group performed repetition exercises on these same words. The absolute improvement and relative improvement of the experimental group as compared to the control group were significant at the .02 and .002 level, respectively. Pedagogical and psycholinguistic implications are noted. (Author/CFM)

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Generative Orthography

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Abstract

The efficacy of teaching the pronunciation of English polysyllables to nonnative speakers by means of ordered rules which use standard orthographic representations as underlying forms was tested on two groups consisting mainly of francophones. The experimental group applied ordered quasiphonological rules to selected words from each of fifteen word classes being tested. The control group performed repetition exercises on these same words. The absolute improvement and relative improvement of the experimental group as compared to the control group were significant at the .02 and .002 level, respectively.

Pedagogical and psycholinguistic implications are noted.

1. Introduction.

1.1 This is a report of some research in applied linguistics which is of psycholinguistic relevance. It is about the efficacy of using ordered quasiphonological rules as a pedagogical technique to teach the pronunciation of English polysyllables to nonnative speakers.[1] The method employs standard orthographic representations and maps them onto systematic phonetic representations.

This project began in the context of some aphasia research (cf. Schnitzer 1972, 1974a, Kehoe and Whitaker 1973, Crothers 1973), involving a patient whose errors could often be most reasonably explained as errors in underlying phonological form followed by correct rule application, or as errors in phonological rules applied to correct underlying representations: relatively simple kinds of errors made at an abstract level often resulted in widespread and random errors at the phonetic level. Since underlying representations are very close to standard spelling in English,[2] I devised sets of rules which mapped standard spellings onto phonetic representations, in an effort to retrain the aphasic; unfortunately, the patient died from a variety of complications not directly related to her neurological problems before it could be determined whether the method produced any substantive results.

However, because of encouraging preliminary results, the method was applied to three native francophones (Schnitzer 1974b), since French speakers have particular difficulty with such matters as stress

assignment, and vowel reduction in English. Considerable amplification of the rules was needed for the three French speakers in this study: it was discovered that although aphasic, the patient, as a native speaker of English, could fill in a lot of information once basic patterns such as stress placement and tonic vowel quality were predicted, whereas the native francophones needed much more detail.

In the pilot study reported on in Schnitzer 1974b, only three subjects were used and the method was applied to only six classes of words (where a word class is defined by suffix), and it gave accurate results only for those subsets considered. Nonetheless, since the method seemed to be effective, some fifty sets of conprehensive rules were devised covering words ending in some 75 suffixes. These were tested on a group of twelve Belgians. Of the fifty rule sets, fifteen were selected for detailed comparison with a control group of francophones. It is these fifteen rule sets covering words ending in nineteen suffixes which constitute the subject of the present report.[3] These fifteen were selected by the following two criteria: first of all, that at least five of the twelve Belgians worked on the rules for the set; and secondly, that the affix was not completely neutral (in the sense of Chomsky and Halle 1968). Of the fifty sets, only fifteen met both of these criteria.

2. Method.

2.1 Subjects.

2.1.1 The experimental subjects consisted of eleven Belgians and one Haitian. The Haitian was natively bilingual in French and Creole. JM was a graduate student in Philosophy at the Université Catholique de Louvain (U.C.L.). All of the other ten subjects were students of Germanic languages, literature and linguistics in the second licentiate at the U.C.L. All were native speakers of French except for MF, who was a native speaker of German, and CC, who was a native speaker of Dutch. All twelve subjects were products of the Belgian francophone school system and none had spent extensive time in an English speaking community except for AM and CD.

2.1.2 The control subjects consisted of five French nationals who were graduate students at the Pennsylvania State University in fields unrelated to English or Germanic.

2.2 Materials. The materials consisted of lists of words ending in the nineteen suffixes being considered here (viz., -ion, -ous, -al, -an, -ent, -ence, -ency, -ant, -ance, -ancy, -ic, -ate, -ize, -ism, -ist, -ible, -able, -age, and -ty), and of rules which related words ending in these suffixes to their phonetic forms (see Appendix, pp.). All words which were exceptions to the rules were excluded from the

word lists. (In a few cases, as many as twenty percent of the words were exceptional in some way.) In the rules a phonetic notation was employed which is maximally close to English orthographic conventions. In cases in which there are alternate pronunciations, the rules derive the form which allows for the simplest formulation of the rules. Thus, for example, the -ia rules assign a uniform /ž/ pronunciation to words ending in Vsia (e.g. Asia /eyže/, aphasia /əfeyže/), yielding pronunciations most consistently heard in North America, rather than the British forms (/eyše/, /əfeyziə/). On the other hand, British pronunciations are derived for words ending in Vrsion (e.g. conversion /kənvəršən/, incursion /Inkəršən/), thereby allowing for a single procedure to handle words ending in Csion.

2.3 Procedures.

2.3.1 The Experimental Group. Each subject was asked to read aloud lists of words ending in the nineteen suffixes mentioned. Errors were noted and totaled for each S for each word class. Each S then applied the rules listed in the appendix to between ten and forty carefully selected words from each word class.

For example, consider the following derivation of reclassification, using the rules for words ending in -ion.

RECLASSIFICATION

-ion Step 1. We number the vowels according to the instructions given in the 'Preliminaries' section (p.).

R E C L A S S I F I C A T I O N
6 5 4 3 2 1

-ion Step 2. We assign the stress to vowel 2, and consult the 'Special Rules' (p.), which tell us that vowel 2 is pronounced /ey/.

R E C L A S S I F I C Á T I O N
6 5 4 3 2 1
(/ey/)

-ion Step 3. Since there is a t to the left of the suffix, but no s left of the t, we rewrite ti as sh, and go to Step 7.

R E C L A S S I F I C Á SH O N
6 5 4 3 2
(/ey/)

-ion Step 7. We perform the Secondary Stress Routine (SSR) (p.).

SSR Step 1.

R E C L A S S I F I C Á S H O N
6 5 4 3 2
III II I
(/ey/)

SSR Step 2. Since there is only one consonant to the right of vowel III, we number one more vowel and go to SSR Step 3.

R E C L A S S I F I C Á S H O N
6 5 4 3 2
IV III II I
(/ey/)

SSR Step 3. Since there are two consonants to the right of vowel IV, we assign secondary stress to the a, and return to the -ion rules.

R E C L À S S I F I C Á S H O N
6 5 4 3 2
IV III II I
(/ey/)

-ion Step 8. Does not apply.

-ion Step 9. The General Rules (pp.), tell us that re is to be pronounced /riy/, that a is to be pronounced /æ/ before two consonants, that sh is /š/, that c is /k/ before a, o, u and all consonants (except h). It also tells us to reduce all unstressed vowels (except u) to /ə/. We then derive:

/r i y k l æ s ə f ə k é y š ə n/

Each subject performed the -ion rules on twenty-four different words.

Now consider this derivation of incorrigibility, using the rules for -ty (pp.).

-ty Step 1.	Since 'incorrigibili' is not a real English word, we go to Step 2.	I N C O R R I G I B I L I T Y
-ty Step 2.	Since there is an i just to the left of the suffix, and since the sequence ibil appears left of i, we perform the ible rules (pp.), counting the first i in ibil as vowel 1.	I N C O R R I G I B I L I T Y 4 3 2 1
-ible Step 1.		I N C O R R I G I B I L I T Y 4 3 2 1
-ible Step 2.	There is only one consonant to the left of the suffix, so we go to Step 3.	
-ible Step 3.	Since vowel 2 is i, we assign stress to vowel 3.	I N C Ó R R I G I B I L I T Y 4 3 2 1
-ible Step 4.	The o is pronounced as /ɔ/ or /a/.	I N C Ó R R I G I B I L I T Y 4 3 2 1 (/ɔ,a/)

-ible Step 5. Does not apply.

-ible Step 6. Since the word we are deriving is incorrigibility and not incorrigible, we must now return to Step 2 of the -ty rules.

-ty Step 2. We now change the primary stress indication to secondary stress indication, erase the numbers and go to Step 3.

I N C O R R I G I B I L I T Y
(/ɔ,a/)

-ty Step 3. Since y is a vowel when final (p.), it is also the leftmost vowel of the suffix.

I N C O R R I G I B I L I T Y
7 6 5 4 3 2 1
(/ɔ,a/)

-ty Step 4. Since vowel 3 is i and it is followed by a consonant, it is pronounced /I/.

I N C C̀ R R I G I B Í L I T Y
7 6 5 4 3 2 1
(/ɔ,a/) (/I/)

-ty Step 5. We remember to pronounce vowel 2 as /ə/.

-ty Step 6. Does not apply since secondary stress has already been assigned.

-ty Step 7. The General Rules (pp.) tell us that g is pronounced as /ǰ/ before i, that the prefix in is pronounced /In/, that the c is pronounced /k/ before o, and that vowels 4 and 5 reduce to /ə/. The rule set says to pronounce ty as /tI/ or /tiy/. Thus we have:

/i n k ɔ̀ r ə ǰ ə b Í l ə t i y/

Each experimental subject performed the -ty rules on twenty-four different words.

For each word class after performing the rules on the related words, each subject was retested on the words which he pronounced incorrectly on first reading. Once again errors were noted and totaled.

2.3.2 The Control Group. The pretesting and retesting procedures for the control group were identical to those employed with the experimental group. The procedures used with the control group differed from those employed with the experimental only in the fact that instead of applying the rules to orthographic representations, the members of the control group performed a repetition exercise: for each word class the experimenter (E) read the carefully selected words to which the experimental group applied the rules and S repeated each word, corrected by E until E was satisfied with S's pronunciation. After this procedure, S was instructed to read this same list of words and was corrected by E if he made a mistake. This routine was continued until S read the entire list of ten to forty specially selected words correctly without the help of E.

Thus, before they were retested, both the experimental and the control groups had mastery over the pronunciation of the specially selected words. The only difference between the two groups was that whereas the experimental group had developed their mastery by means of ordered rules, the control group had acquired theirs by means of repetition exercises.

3. Results.

3.1 The results for the fifteen rule sets are summarized in tables 1-15. In each table the first column lists the initials of the subjects in the experimental and control groups. The second column indicates the number of words each S pronounced incorrectly in the pretest. The third column indicates the number of words each S mispronounced in the post test. The column headed Δ indicates the difference between the number of errors made in the pretest and number made in the retest. The % column indicates the relative difference between the number of errors made in the retest and the number made in the pretest. It is calculated by dividing the figure in the Δ column by the figure in the column labeled Pre.

The experimental group was compared with the control group with respect to Δs and %s by means of a two tailed Mann-Whitney U-test. P values are noted (along with the calculated U value), at the bottom of their respective columns. Thus the p values indicate the significance of the difference in performance by the experimental group and the control group in relation to both absolute improvement (Δ p value) and relative improvement (% p value).

Experimental Subjects	Pre	Post	Δ	%
PG	91	29	62	.681
JB	76	19	57	.750
CD	77	12	65	.844
MF	178	19	159	.893
HD	174	19	155	.890
BD	162	30	132	.814
CP	141	23	118	.836
CC	133	21	112	.842
KL	222	19	203	.914
AM	64	8	56	.875
PP	83	22	61	.734
Control Subjects				
AL	174	119	55	.316
JC	224	124	100	.446
NR	198	134	64	.323
RG	195	116	79	.405
SV	156	100	56	.358
	U = 8 p <.05		U = 9 p =.05	U = 0 p <.002

Number of words = 519

Table 1. Figures for words ending in -ion

Experimental Subjects	Pre	Post	Δ	%
PG	61	23	38	.622
JB	79	20	59	.746
CD	83	13	70	.843
MF	122	21	101	.827
HD	120	12	108	.900
BD	153	26	127	.830
CP	107	22	85	.794
CC	110	22	88	.800
KL	94	16	78	.829
AM	51	10	41	.803
PP	87	10	77	.885
Control Subjects				
AL	162	114	48	.296
JC	131	101	30	.229
NR	122	86	36	.295
RG	134	109	25	.186
SV	130	86	44	.338
	U = 4 p <.02		U = 4 p <.02	U = 0 p <.002

Number of words = 239

Table 2. Figures for words ending in -ous

Experimental Subjects	Pre	Post	Δ	%
PG	88	18	70	.795
JB	59	14	45	.762
CD	72	20	52	.722
MF	119	28	91	.764
HD	147	25	122	.829
BD	172	29	143	.831
CP	109	22	87	.798
CC	103	26	77	.747
KL	150	29	121	.806
AM	58	12	46	.793
PP	90	16	74	.822
Control Subjects				
AL	231	137	94	.406
JC	169	110	59	.349
NR	162	105	57	.351
RG	163	106	57	.349
SV	129	66	63	.488
	U = 6 p <.02		U not in table p >.05 (n.s.)	U = 0 p <.002

Number of words = 369

Table 3. Figures for words ending in -al

Experimental Subjects	Pre	Post	Δ	%
PG	47	8	39	.829
JB	72	13	59	.819
CD	55	10	45	.818
MF	80	13	67	.837
HD	87	9	78	.896
PD	109	14	95	.871
CP	72	23	49	.680
CC	46	7	39	.847
KL	71	12	59	.8309
AM	28	8	20	.714
PP	65	11	54	.8307
Control Subjects				
AL	102	78	24	.235
JC	114	86	28	.245
NR	79	51	28	.354
RG	87	57	30	.344
SV	85	52	33	.388
	U = 7 p =.02		U = 5 p <.02	U = 0 p <.002

Number of words = 153

Table 4. Figures for words ending in -an

Experimental Subjects	Pre	Post	Δ	%	Post'	Δ'	% '
PG	153	18	135	.882	33	120	.784
JM	350	64	286	.817	--	--	--
JB	156	29	127	.814	31	125	.812
CD	106	16	90	.849	28	78	.735
MF	214	22	192	.897	25	189	.883
HD	250	25	225	.900	51	199	.796
BD	254	21	233	.917	44	210	.826
CP	185	17	168	.908	36	149	.805
CC	214	36	178	.831	41	173	.808
KL	221	30	191	.864	29	192	.868
AM	125	11	114	.912	17	108	.864
PP	154	13	141	.915	24	130	.844
Control Subjects							
AL	389	211	178	.457			
JC	246	184	62	.252			
NR	257	146	111	.431			
RG	279	205	74	.265			
SV	202	105	97	.480			

U = 9 p = .05 U = 7 p < .02 U = 0 p < .002 U = 10 p > .05 (n.s.) U = 0 p < .002

Number of words = 485

Table 5. Figures for words ending in -ence, -ency, -ent

Experimental Subjects	Pre	Post	Δ	%
PG	82	20	62	.756
JB	71	11	60	.845
CD	74	17	57	.770
MF	221	23	198	.895
HD	159	16	143	.899
BD	233	28	205	.879
CP	129	22	107	.842
:C	113	14	99	.876
KL	148	20	128	.864
AM	61	4	57	.934
PP	86	11	75	.872
Control Subjects				
AL	374	235	139	.371
JC	226	163	63	.278
NR	226	150	76	.336
RG	203	140	63	.310
SV	160	69	91	.568

U = 2
p = .002

U not in table
p > .05
(n.s.)

U = 0
p < .002

Number of words = 451

Table 6. Figures for words ending in -ance, -ancy, -ant

Experimental Subjects	Pre	Post	Δ	%	Post'	Δ'	%'
PG	169	34	135	.79881	46	123	.727
JB	173	44	129	.745	44	129	.745
CD	156	28	128	.820	69	87	.557
MF	202	37	165	.816	38	164	.811
HD	245	38	207	.844	52	193	.787
BD	259	43	216	.833	45	214	.826
CP	169	40	129	.763	62	107	.633
CC	179	36	143	.79888	42	137	.765
KL	227	54	173	.762	40	187	.823
AM	113	18	95	.840	42	71	.628
PP	177	35	142	.802	39	138	.779
Control Subjects							
AL	243	202	41	.168			
JC	210	119	93	.442			
NR	176	124	52	.295			
RG	220	167	53	.240			
SV	197	161	36	.182			

U not in table p > .05 (n.s.)	U = 0 p <.002	U = 0 p < .002	U = 2 p =.002	U = 0 p <.002

Number of words = 428

Table 7. Figures for words ending in -ic

Experimental Subjects	Pre	Post	Δ	%
PG	26	4	22	.846
CD	22	0	22	1.000
MF	36	0	36	1.000
CC	46	6	40	.869
PP	59	3	56	.949
Control Subjects				
AL	136	98	38	.279
JC	126	68	58	.460
NR	176	120	56	.318
RG	111	84	27	.243
SV	109	60	49	.449
	U = 0 p < .02		U = 6 p > .05 (n.s.)	U = 0 p < .02

Number of words = 220

Table 8. Figures for words ending in -ate

Experimental Subjects	Pre	Post	Δ	%
PG	39	10	29	.743
JB	32	8	24	.750
CD	23	3	20	.869
MF	32	8	24	.750
HD	37	5	32	.864
BD	46	9	37	.804
CP	23	6	17	.739
CC	26	7	19	.730
Control Subjects				
AL	109	55	54	.495
JC	52	28	24	.461
NR	139	76	63	.453
RG	93	56	37	.397
SV	49	35	14	.285
	U = 0 p = .002		U = 10 p > .05 (n.s.)	U = 0 p = .002

Number of words = 139

Table 9. Figures for words ending in -ize

Experimental Subjects	Pre	Post	Δ	%
PG	97	24	73	.752
JB	77	18	59	.766
CD	71	22	49	.690
MF	70	23	47	.671
HD	90	26	64	.711
BD	99	26	73	.737
CP	106	28	78	.735
CC	66	20	46	.696
KL	156	35	121	.775
AM	63	15	48	.761
PP	75	24	51	.680
Control Subjects				
AL	223	191	32	.143
JC	141	109	32	.226
NR	217	137	80	.368
RG	216	161	55	.254
SV	212	200	12	.056
	U = 1 p < .002		U not in table p > .05 (n.s.)	U = 0 p < .002

Number of words = 222

Table 10. Figures for words ending in -ism

Experimental Subjects	Pre	Post	Δ	%
PG	44	6	38	.863
JB	31	4	27	.870
CD	40	9	31	.775
MF	75	14	61	.813
HD	55	4	51	.927
BD	101	15	86	.851
CP	57	20	37	.649
CC	54	11	43	.796
KL	42	5	37	.880
AM	29	4	25	.862
PP	52	15	37	.711
Control Subjects				
AL	74	61	13	.175
JC	87	56	31	.358
NR	74	57	17	.229
RG	60	49	11	.183
SV	109	72	37	.339

U = 4, $p < .02$ U = 5, $p < .02$ U = 0, $p < .002$

Number of words = 109

Table 11. Figures for words ending in -ia

Experimental Subjects	Pre	Post	Δ	%
PG	27	2	25	.925
JB	22	1	21	.954
CD	14	1	13	.928
MF	26	1	25	.961
HD	25	3	22	.880
BD	31	1	30	.967
CP	23	2	21	.913
CC	18	2	16	.888
KL	15	1	14	.933
PP	16	1	15	.937
Control Subjects				
AL	137	60	77	.562
JC	57	29	28	.491
NR	35	20	15	.428
RG	78	47	31	.397
SV	41	24	17	.414
	U = 0 p < .002		U = 8 p = .05	U = 0 p < .002

Number of words = 134

Table 12. Figures for words ending in -ible

Experimental Subjects	Pre	Post	Δ	%
PG	140	25	115	.821
JB	138	24	114	.826
CD	125	18	107	.856
MF	116	22	94	.810
HD	179	37	142	.793
BD	112	25	87	.776
CP	129	18	111	.860
CC	94	23	71	.755
KL	137	21	116	.846
AM	71	12	59	.830
PP	69	12	57	.826
Control Subjects				
AL	433	283	150	.346
JC	437	225	212	.485
NR	225	195	30	.133
RG	290	166	124	.427
SV	239	156	83	.347
	U = 0 p < .002		U not in table p > .05 (n.s.)	U = 0 p < .002

Number of words = 505

Table 13. Figures for words ending in -able

Experimental Subjects	Pre	Post	Δ	%
PG	21	9	12	.571
CD	24	6	18	.750
MF	27	6	21	.777
CC	23	10	13	.565
AM	16	6	10	.625
PP	22	5	17	.772
Control Subjects				
AL	88	40	48	.545
JC	40	26	14	.350
NR	40	30	10	.250
RG	53	49	4	.075
SV	43	24	19	.465
	U = 0 p = .002		U = 14 p > .05 (n.s.)	U = 0 p = .002

Number of words = 131

Table 14. Figures for words ending in -age

Experimental Subjects	Pre	Post	Δ	%
PG	92	17	75	.815
JB	93	15	78	.838
CD	109	15	94	.862
MF	64	15	49	.765
HD	90	16	74	.822
BD	103	13	90	.873
CP	89	12	77	.865
CC	109	10	99	.908
AM	38	13	25	.657
PP	64	12	52	.812
Control Subjects				
AL	281	147	134	.476
JC	169	101	68	.402
NR	126	118	8	.063
RG	111	92	19	.342
SV	91	69	22	.241
	U = 5 p < .02		U = 13 p > .05 (n.s.)	U = 0 p < .002

Number of words = 147

Table 15. Figures for words ending in -ty

3.2 Notice that although all of the % values are highly significant ($p = .004$ or better for all sets), about half of the Δ values are not. The fact that some Δs are not significant may be ascribed partially to the fact that in general, the control subjects made more errors on the pretests than did the experimental subjects. Hence, they usually had more words to reread than did the experimental group since, as noted in section 2.3.2, subjects were asked to reread only those words which they had mispronounced on the pretest. Therefore, one would expect that since a larger number of words were reread by the control subjects than by the experimental subjects, control group absolute differences (Δs) might approach those of the experimental group solely because of the greater number of words being reread by the control group subjects. The greater the difference between the experimental and control groups' pretest scores is, the more plausible this interpretation becomes; the Mann-Whitney test shows that the control subjects made significantly more errors in all the pretests than did the experimental subjects. (p values are .05 or better; see the bottom of the Pre column in Tables 1-15 for the U and p value for each affix set.)

3.3 The nonsignificance of some of the Δs may also be partially ascribed to the fact that some of the rule sets leave some degree of indeterminacy in deriving pronunciation from spelling. Thus for words ending in -ant, -ancy, -ize, and -ism the vowel pronunciations are not predicted by the rules. For words ending in -able,

-age, and -ty the rules predicting the vowel pronunciation do not always apply (sometimes one must know the pronunciation of the stem in order to apply the rules to the derived form). For words in -al there are two sets of rules for normal pronunciation (depending on which syllable is stressed). These two different sets could lead to confusion. The Δ values for all these words were nonsignificant.[4]

On the other hand, the rules for the word classes for which the Δ s were significant tended to have deterministic rules.[5]

3.4 Nevertheless, when one averages the Δ scores for each subject over all word classes

(i.e. $\text{Av } \Delta = \frac{\Sigma \text{ Pretest errors} - \Sigma \text{ Retest errors}}{\text{Number of sets read}}$:

The total of all pretest errors for all word classes tested minus the total of all retest errors for all classes tested for each subject, divided by the number of affix sets read by the subject.), one finds that the overall Δ value is significant ($p = .02$).

Considering all the sets read for each subject we also find that $p < .002$ for the % s. The percentage values are calculated as follows: $\frac{\text{Av } \Delta}{\text{Av. Pretest Score}}$

The Av. Pretest Score for each S is determined by totaling the number of pretest errors for all word classes and dividing that number by the number of word groups tested for the subject.

These results are found in Table 16.

Experimental Subjects	No.Af. Sets	Σ Pre	Av.Pre	Σ Δ	Av. Δ	% Imp.= Av. Δ / Av.Pre
PG	15	1151	76.7	908	60.5	78.8
JB	13	1057	81.3	856	68.5	84.2
CD	15	1029	68.6	839	55.9	81.4
MF	15	1546	103.1	1294	86.3	83.7
HD	13	1658	127.5	1423	109.5	85.0
BD	13	1834	141.1	1554	119.5	84.0
CP	13	1339	103.0	1084	83.4	81.0
CC	15	1228	85.9	1043	69.5	80.9
KL	11	1483	134.8	1241	112.8	84.1
AM	12	732	61.0	596	49.7	81.5
PP	14	1040	74.3	853	60.9	81.9
Control Subjects						
AL	15	3020	201.3	1087	72.5	36.0
JC	15	2303	153.5	844	56.3	36.6
NR	15	2076	138.4	647	43.1	46.7
RG	15	2182	145.5	662	44.1	30.3
SV	15	1843	122.9	658	43.9	35.7
				U = 7		U = 0
				p =.02		p <.002

Table 16. Summary of figures for all sets read by each subject

3.5 Long Term Results. Approximately four months following this retest of the experimental subjects on the words ending in -ic, -ent, -ency, and -ence, they were retested again on these words. This time they were asked to reread the entire word lists, not just those words which they mispronounced on the pretest. The number of errors made on this test are listed for each subject in the column headed Post in Tables 5 and 7. The Δ ' and % ' values are relative to the Pretest scores. The control subjects were not retested a second time and the U values and p values noted under those columns are relative to the control group's performance on the immediate retest. The reader will note that there is no diminution in the p values relative to the original score except with respect to the absolute (i.e. Δ) score for -ent, -ence, -ency words: this is despite the fact that the experimental subjects did not systematically work with the rules for these words during the four month interval.

4. Conclusion and Discussion.

4.1 The results presented and discussed above indicate that the use of ordered rules applied to standard English orthography can be a successful method for teaching the pronunciation of English polysyllables to advanced students of English who have not had the opportunity to live in an anglophone community. Although the results were much better for wome word classes than for others (see the discussion in sections 3.2 and 3.3), the method seems to be useful

in general: it is better to have rules which do not work perfectly, than to have no rules at all; in the latter case everything is an exception which must be memorized.

It is the author's hope that this method will be put to practical use by students of English. Learning English Pronunciation by Rule (Schnitzer, to appear c), is a workbook consisting of some fifty lessons including listening exercises with tapes and rule-application exercises of the type described herein. Hopefully this method can be extended for use in the teaching of other languages.

4.2 Undoubtedly, there are difficulties to be found in the study described in the paper both of a theoretical and methodological sort. The experimental group consisted primarily of Belgian francophones who had not spent a substantial period of time in an anglophone speech community but who were students of English. The control group were residents in the United States at the time of the study. Furthermore, it is possible that the Belgian students were accustomed to learning languages via analytical means of the type proposed herein. It is conceivable that the results of a study involving the rule sets proposed in this paper would be different with a different sort of population in the experimental group, e.g. nonstudents of English, nonstudents, high school students, nonfrancophones, older people. Hopefully these questions can be approached in future investigations.

4.3 The results of the research reported above raises many issues which are beyond the scope of this paper but which seem worth pursuing: to what extent are native speakers of English aware of the orthographic-phonetic correspondences of the type and complexity discussed herein? To what extent do they realize morphological and/or etymological relationships between words spelled similarly but pronounced differently? To what extent do native speakers use strategies sensitive to such regularities in pronouncing unfamiliar words encountered in reading, or in spelling words which are familiar only to the auditory modality? Is there a correlation between how good a speller someone is and the extent to which he avails himself of such strategies? To what extent can nonnative speakers learn to induce such relationships without explicit training?

These are interesting questions which can be tested experimentally. The answers to these and other related questions can shed light on how people organize their lexicons.

Appendix

Materials employed by the experimental subjects

Preliminaries

A FEW PRELIMINARY REMARKS

1. In performing the rules contained in this book, you will often encounter the instructions 'Number the vowels'. This means to start with the leftmost vowel of the suffix as number one, and to count each vowel of the word, going from Right to Left. So for example, the following two words with the suffixes -ion and -ate, respectively, would be numbered as follows:

C O N T R I T I O N
3 2 1

I N V E S T I G A T E
4 3 2 1

2. When you are told to assign stress, you are to assign primary stress. When instructed to assign primary stress to a certain vowel, place a mark like this (´) over the vowel. Secondary stress (marked thus (`)) will always be referred to as 'secondary stress'.

3. If you are instructed to assign stress to a vowel with a number which does not exist for a given word, assign the stress to the vowel with the next highest number. For example, if you are instructed to assign stress to vowel four of 'diagram', you cannot because the vowel with the highest number is the i, and it is vowel three.

D I A G R A M
3 2 1

Therefore, you should assign stress to vowel number three; it is the vowel with the next highest number to four.

4. The specific rules mentioned in the sets of rules always take precedence over the General Rules, should the rules be in conflict.

DEFINITIONS

after: immediately to the right of

before: immediately to the left of

beginning: leftmost, furthest to the left

between: 'between x and y' means that x is left of the item and y is right of the item.

digraph: 1) Two orthographic vowels combined to form a single vocalic nucleus of a syllable.

e.g. READ /riyd/
BOOT /buwt/
HAIR /heHr/
LAUGH /læf/, /la:f/

or

2) Two orthographic consonants combined to form a single pronounced consonant.

e.g. LAUGH /læf/, /la:f/
THING /θIŋ/
PHONY /fowniy/

ending: rightmost, furthest to the right

final: rightmost, furthest to the right

finally: occurring furthest to the right

follow: to occur immediately to the right of

followed by: immediately to the left of

initial: leftmost, furthest to the left

initially: occurring furthest to the left

precede: to occur immediately to the left of

preceded by: immediately to the right of

GENERAL RULES

I. General Rules for consonants:

b	= /b/	n	= /n/
d	= /d/	p	= /p/
f	= /f/	r	= /r/
j	= /ǰ/ = /dž/	t	= /t/
k	= /k/	v	= /v/
l	= /l/	w	= /w/
m	= /m/	z	= /z/

c = /s/ when it is just to the left of i, e, or y. (ceiling)
/k/ everywhere else (except when part of a digraph). (cake)

g = /ǰ/ when it is just to the left of i, e, or y. (gem)
/g/ elsewhere (except when part of a digraph). (gap)

h = is silent when final (except when part of a digraph).
/h/ elsewhere (except when part of a digraph).

s = /z/ between two vowels or between a vowel and an m or an n.
/s/ elsewhere.

x = /ks/ and it counts as two consonants.
/z/ when initial.

ph = /f/ and it counts as one consonant.

th = /θ/ or /ð/ and it counts as one consonant.

zh = /ž/ = /ʒ/ and it counts as one consonant.

sh = /š/ = /ʃ/ and it counts as one consonant.

ch = generally sounds like /č/ (= /tʃ/). Sometimes it sounds like /k/. It always sounds like /k/ when it is to the left of another consonant. It counts as one consonant.

ps = /s/ initially
/ps/ elsewhere

y = is a consonant except when final or when it comes between two consonants (or when otherwise noted). When y is a consonant, it sounds like /j/ (= /y/).

qu = counts as one consonant and is pronounced /kw/.

š, č, and ǰ count as single consonants wherever used herein.

II. General Rules for Vowels.

a, e, i, o, and u are vowels. y is a vowel when final or when it comes between two consonants.

The following rules do not always work, but should serve as general guidelines.

1. Rules for u.

   i. /ə/ if followed by r + consonant (e.g. urt as in hurt).
   See rules for r-clusters below.

   ii. /ʌ/ if followed by two consonants. (luck)

   iii. /uw/ when preceded by r or l (unless i. or ii. applies).
   (rule)

   iv. /w/ when preceded by q. qu counts as one consonant. (quote)

   v. /yuw/ everywhere else. (mule)

2. Rules for r-clusters

These are the pronunciations of vowels when followed by r + consonant:

a (+ r + consonant) = /a/

o (+ r + consonant) = /o/

{i, e, u} (+ r + consonant) = /ə/

3. Guidelines for vowel pronunciation.

   i. These are generally the pronunciations of vowels when followed by two consonants:

   a = /æ/ i = /I/

   e = /ɛ/ o = /ɔ/, /a/

   ii. These are generally the pronunciations of vowels when followed by one consonant:

   a = /ey/ or /æ/ i = /ay/ or /I/

   e = /iy/ or /ɛ/ o = /ow/ or /ɔ/, /a/

iii. i followed by a vowel is /ay/ when stressed. See below for unstressed i.

4. Unstressed Vowels.

When vowels are not stressed, they are generally reduced. Unstressed e followed by a, i, or o is generally /iy/. Unstressed i followed by e, a, o, or u is generally /iy/. Unstressed e and i in other environments, and unstressed a and o in most environments are pronounced as /ə/.

5 y is a vowel when final or when it occurs between two consonants (or when otherwise noted). When y is a vowel, it generally follows the pronunciation rules for i.

6. Note: au = rewrite as /ɔ:/, whenever you see it.

7. Note: eu = /yuw/

III. Prefixes.

1. Invariant Group.

Although the following prefixes may be pronounced in different ways in different environments by different native speakers, you will never be incorrect if you use the following pronunciations.

bi-	/bay/	pre-	/priy/
di-, dy-	/day/	psych-	/sayk/
dis-, dys-	/dIs/	re-	/riy/
demi-	/dɛ̃mi/	retro-	/rɛ̃trow/
hemi-	/hɛ̃mi/	semi-	/sɛ̃mi/
iso-	/aysow/	sub-	/sʌb/
mis-	/mIs/	sur-	/sə(r)/
non-	/nɔn/, /nan/	tri-	/tray/
post-	/powst/	un-	/ʌn/

2. Variant Group.

For each of the following prefixes, use pronunciation (1) unless stress falls on the second syllable of the prefix. In the latter case, use pronunciation (2). For example, pronunciation (1) of the prefix demo- is /dɛ̃mə / and pronunciation (2) is /demɔ́/; thus we find the pair of English words /dɛ̃mə krӕt/ -- /demɔ́kresi/.

apo- (1) /æpə/; (2) /epɔ́/, /epá/
anti- (1) /æntay/; (2) /æntÍ/
auto- (1) /ɔ:tə/; (2) /ɔ:tɔ́/, /ɔ:tá/
demo- (1) /dɛ̃mə/; (2) /demɔ́/, /demá/
geo- (1) /jiyə/; (2) /jiyɔ́/, /jiyá/
inter- (1) /Întə(r)/; (2) /Intɔ́(r)/
meta- (1) /mɛ̃tə/; (2) /mɛ̃tǽ/
micro- (1) /maykrə/; (2) /maykrɔ́/, /maykrá/

mono- (1) /mɔnə/, /manə/; (2) /monə́/, /mənə́/

multi- (1) /mʌ́ltI/; (2) /mʌltĺ/

neo- (1) /niyə/; (2) /niyə́/, /niyə́/

para- (1) /pærə/; (2) /pərə́/

phono- (1) /fownə/; (2) /fənə́/, /fənə́/

poly- (1) /pɔli/, /pali/; (2) /pəlĺ/

super- (1) /s(y)ú̇wpə(r)/; (2) /s(y)uwpə́(r)/

tele- (1) /tɛ̆lə/; (2) /təlɛ̆́/

3. Two more

ex- is usually pronounced /ɛ̆ks/; however, when it is just to the left of a stressed vowel it is pronounced /ɛ̆gz/. (e.g. extract /ɛ̆kstrǽkt/ -- exact /ɛ̆gzǽkt/).

hy- is pronounced /hay/ before -per, -po, and -dro.

SPECIAL RULES

I. Pronunciation of vowel followed by two consonants followed by ion, ian, ial, ia, ious, eous:

a + Consonant + Consonant e + Consonant + Consonant i + Consonant + Consonant o + Consonant + Consonant u + Consonant + Consonant	+	ion ian ial e/i ous ia

a = /æ/
e = /ɛ/
i = /I/
o = /ɔ/, /a/
u = /ʌ/

Note that if the first (leftmost) of the two consonants is r, the rules for r-clusters should be followed instead of the above rules.

II. Pronunciation of vowel followed by one consonant followed by ion, ian, ial, ia, ious, eous:

a + Consonant e + Consonant i + Consonant o + Consonant u + Consonant	+	ia ial e/i ous ion ian

a = /e(y)/
e = /i(y)/
i = /I/
o = /o(w)/
u = /(y)u(w)/*

III. When the i (or e) of ion, ious, eous, ian, ial, or ia remains in the last step in a set of rules (that is, if it has not been erased), it is pronounced as /iy/. The o, ou, or a following the i (or e) are pronounced as /e/ regardless of whether the i

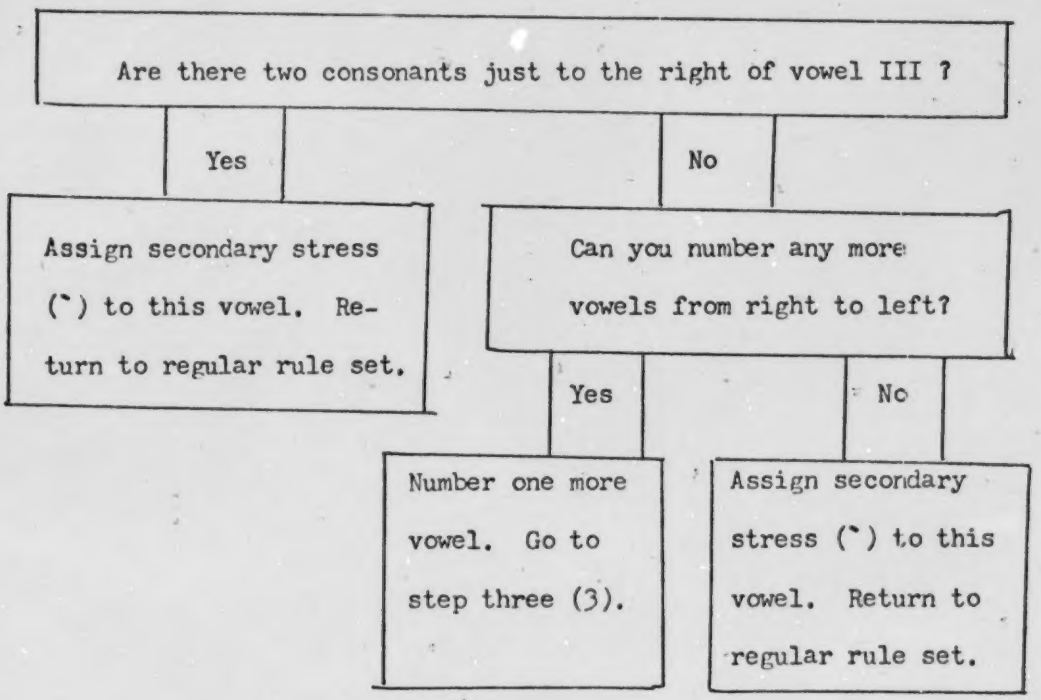
*See the rules for u.

has been erased or not.

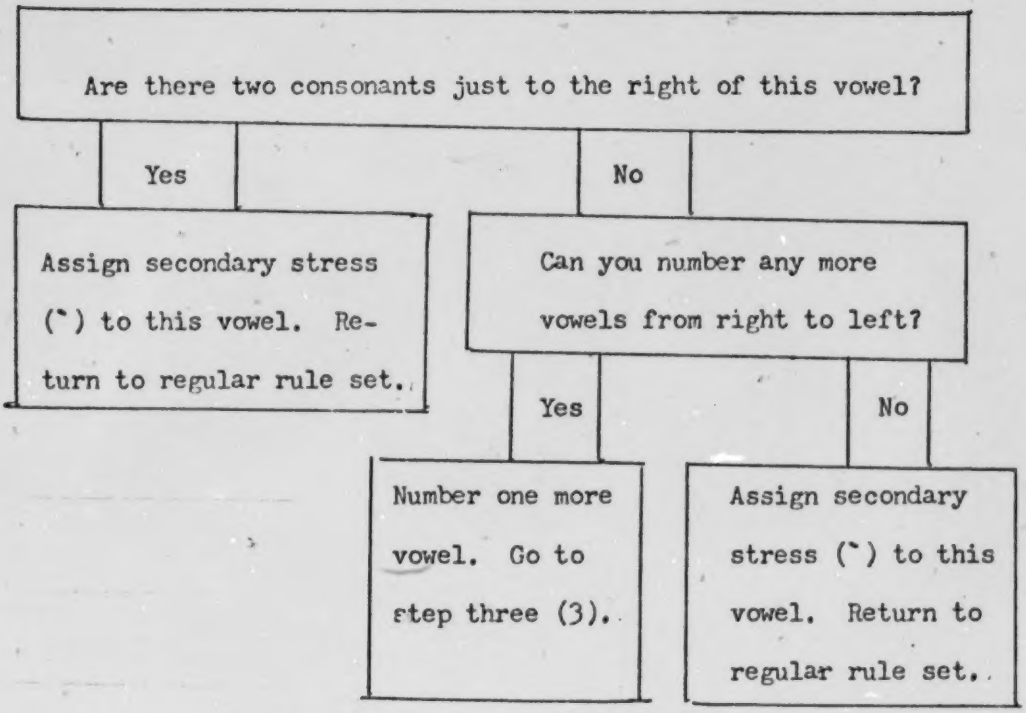
IV. Do not pronounce the /y/'s and /w/'s in parentheses, when there is an r just to the right. (e.g. -arion is pronounced /ériyən/, not /éyriyən/).

SECONDARY STRESS ROUTINE

1. If possible, number three vowels using Roman numerals (e.g. I, II, III) from the one receiving stress, going from right to left, as usual. The vowel which has been assigned primary stress counts as I. If you cannot number the vowels because the word is too short, ignore the following, and return to the regular rule set.

2. 
Are there two consonants just to the right of vowel III ?
Yes
No
Assign secondary stress (ˋ) to this vowel. Return to regular rule set.
Can you number any more vowels from right to left?
Yes
No
Number one more vowel. Go to step three (3).
Assign secondary stress (ˋ) to this vowel. Return to regular rule set.

3.


Are there two consonants just to the right of this vowel?
Yes
No
Assign secondary stress (`) to this vowel. Return to regular rule set.
Can you number any more vowels from right to left?
Yes
No
Number one more vowel. Go to step three (3).
Assign secondary stress (`) to this vowel. Return to regular rule set.

Note that this routine accounts for secondary stress only about eighty percent of the time.

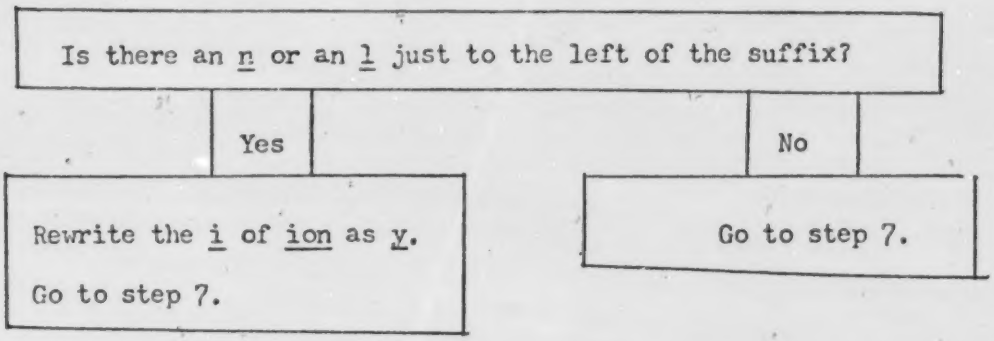
Rules for Specific Classes of Words

-ion

1. Number the vowels.
2. Assign stress to vowel 2. Consult the Special Rules.
3. Is there a t just to the left of the suffix?
   - Yes → Is there an s just to the left of the t?
     - Yes → Rewrite the t as ch and erase the i of ion. Go to step 7.
     - No → Rewrite the t as sh and erase the i of ion. Go to step 7.
   - No → Go to step 4.
4. Is there an s just left of the suffix?
   - Yes → Is there a vowel just to the left of the s?
     - Yes → Rewrite the s as zh. Erase the i of ion. Go to step 7.
     - No → Erase the i of ion. Rewrite the s as sh. Go to step 8.
   - No → Go to step 5.

5. If there is a g just left of the suffix, erase the i of ion, rewrite the g as j, and go to step 7. Otherwise go to step 6.

6.



7. Perform the Secondary Stress Routine.

8. If vowel 4 is e, it is usually pronounced as /ɛ/ (except in r-clusters).

9. Pronounce the word.

-ous /əs/ (Adjectives)

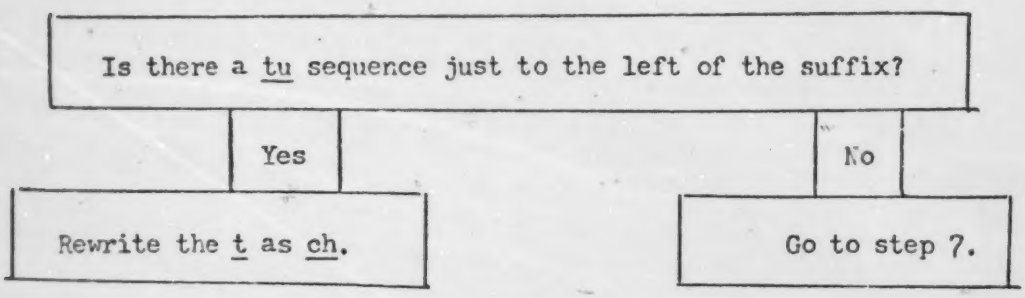
1. Number the vowels.

2. If there are 2 consonants just left of the suffix, assign stress to vowel 2 and go to step 7; otherwise assign stress to vowel 3.

3. Is there an i just to the left of the suffix?
   - No → Go to step 4.
   - Yes → Is there a t just to the left of the i?
     - No → Go to step 4.
     - Yes → Consult the Special Rules . Rewrite the t as sh. Go to step 5.

4. Is there an e or an i just to the left of the suffix?
   - No → Go to step 6.
   - Yes → If there is a c to the left of the e or i, rewrite the c as sh.
     If there is a g to the left of the e or i, rewrite the g as j.
     Consult the Special Rules . Go to step 5.

5. Erase any i or e which is just to the right of a j or an sh.

6. 

7. Perform the Secondary Stress Routine.

8. If vowel 3 is stressed and it is e, then if vowel 2 is u, pronounce the e as /ɛ/ (unless it is in an r-cluster).

9. Check the General Rules for guidance for vowels not specified by the Special Rules.

10. Pronounce the word.

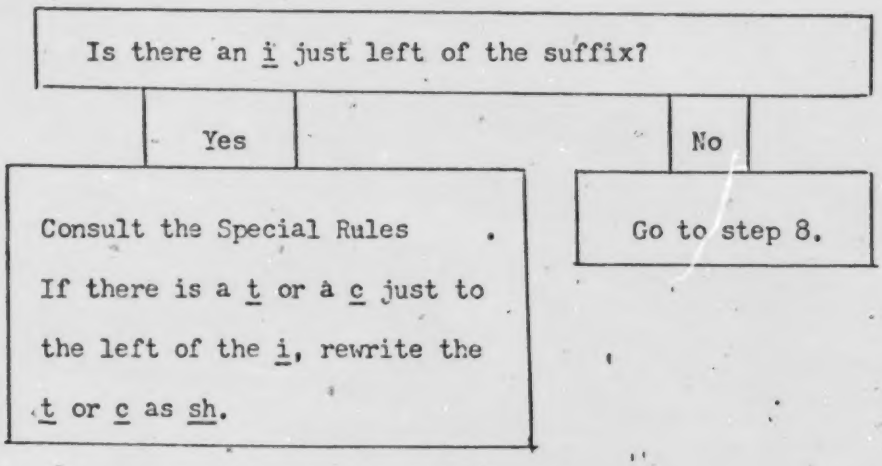
-al /el/ (Adjectives)

1. If there is an ion sequence just left of the suffix, perform the -ion rules (lesson 1) first, counting the i of ion as vowel 1, and then go to step 10 below.
2. Number the vowels.
3. Is there a consonant just to the left of the suffix?
   - Yes → Is this consonant a v or a y?
     - Yes → Place stress on vowel 2. If vowel 2 is i, it is pronounced /ay/. Go to step 8.
     - No → Are there 2 consonants just to the left of the suffix?
       - Yes → Place stress on vowel 2. Go to step 8.
       - No → Go to step 4.
   - No → Is vowel 2 a u?
     - Yes → If there is an s just left of the u, rewrite the s as zh; if there is a consonant just left of the zh, rewrite the zh as sh. If there is a t just left of the u, rewrite the t as ch. Go to step 5.
     - No → Go to step 5.

4. If the sequence cid appears just left of the suffix, assign stress to vowel 2; the i of cidal is pronounced /ay/.

5. If stress has not yet been assigned, assign it to vowel 3.

6.


Is there an i just left of the suffix?
Yes
No
Consult the Special Rules
If there is a t or a c just to the left of the i, rewrite the t or c as sh.
Go to step 8.

7. Erase all i's which are just to the right of sh's.

8. Is there an ic sequence just left of the suffix?

Yes

Vowel 3 is pronounced as follows:

a: Pronounced as /ey/ if there is no consonant between vowel 2 and vowel 3 or if there is only one consonant and it is s.

If the a is followed by r + consonant (e.g. art), the a is pronounced as /a/. Otherwise the a is /æ/.

e: Pronounced as /iy/ if there is no consonant between vowel 2 and vowel 3 or if there is only one consonant and it is s or g.

If the e is followed by r + consonant (e.g. erg), then it is pronounced as /e/.

In all other cases, the e is /ɛ/.

o: Pronounced as /ow/ if there is no consonant between vowel 2 and vowel 3 or if there is only one consonant and it is b.

If there is an r + consonant following the o (e.g. orb), the o is pronounced as /o/.

Otherwise the o is pronounced as /ɔ/, /a/.

u: Pronounced as /uw/ if there is an r just left of vowel 3.

Otherwise it is /yuw/.

If vowel 3 is i or y, pronounce vowel 3 as /I/.

No

Go to step 9.

9. Perform Secondary Stress Routine.

10. Check the General Rules. Pronounce the word.

-an /ən/ (Adjectives).

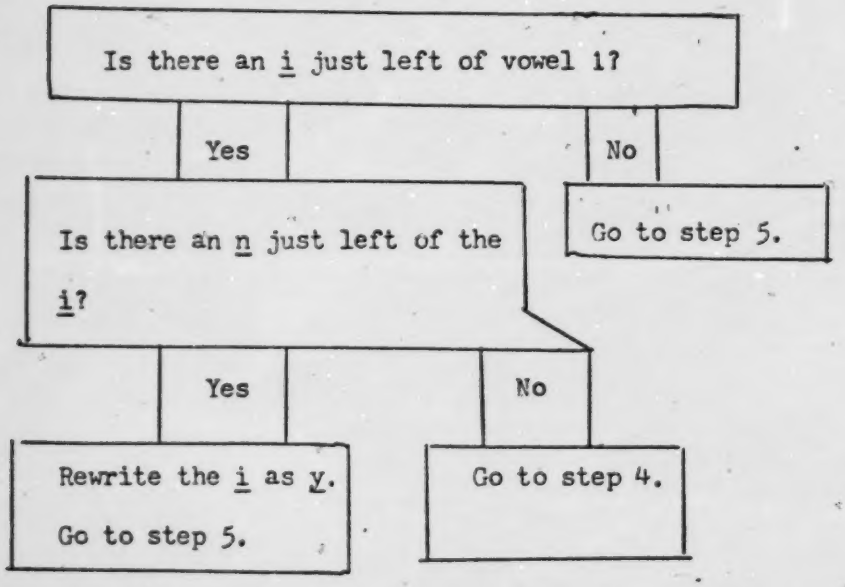
1. Number the vowels.
2. If there are 2 consonants just to the left of the suffix, then the stress is on vowel 2.
3. If vowel 2 is o, e, or u, then the stress is on vowel 2.
4. If stress has not yet been assigned, place it on vowel 3.
5. Is there an i just to the left of the suffix?
   - No → Go to step 7.
   - Yes → Consult the Special Rules.
     If there is a t or a c just to the left of the i, rewrite the t or c as sh.
     If there is a g just to the left of the i, rewrite the g as a j.
     Is there an s just to the left of the i?
     - No → Go to step 7.
     - Yes → If there is another s just to the left of the s, rewrite the ss as sh. If there is a vowel just to the left of the s, rewrite the s as zh.
6. Erase all i's which are just to the right of j's or sh's or zh's.

7. Perform the Secondary Stress Routine.

8. Consult the General Rules. Pronounce the word.

-ency /ənsiy/, -ence /əns/, (Nouns)

-ent /ənt/, (Adjectives, Nouns)

1. Number the vowels. If the word ends in -ment see the rules for -ment (Lesson 31).
2. If there are 2 consonants immediately to the right of vowel 2, assign stress to vowel 2. If vowel 2 is a or e, assign stress to vowel 2. Otherwise assign it to vowel 3.
3. 
Is there an i just left of vowel 1?
Yes
No
Go to step 5.
Is there an n just left of the i?
Yes
No
Rewrite the i as y. Go to step 5.
Go to step 4.
4. If there is a c, sc, or t just left of the i, rewrite the c, sc, or t as š.
5. Rules for stressed vowels:
   i. If vowel 3 is stressed, pronounce vowel 3 as follows: When vowel 3 is followed by r + consonant, see Rules for r-clusters ( ). Otherwise vowel 3 is as follows when stressed:

i = /I/

a is /ey/ when followed by 1 consonant + ie (e.g. atie)
or by a consonant + ye (e.g. avye).
Otherwise a is /æ/.

u = /uw/

o = /ɔ/

e is /iy/ when followed by a consonant + ie (e.g. edie),
or by 1 consonant + ye (e.g. enye).
Otherwise e is /ɛ/.

ii. If there is an i just to the right of an š, erase the i.

iii. If vowel 2 is stressed, pronounce vowel 2 as follows:

o followed by r is /o/.

o followed by 2 consonants is /ɔ/, /a/.

o is /ɔw/ elsewhere.

u is /ə/ when followed by r + consonant (e.g. urg).

u is /ʌ/ when followed by 2 consonants.

u is /uw/ elsewhere.

e is /e/ when followed by r + consonant (e.g. erg).

e is /ɛ/ when followed by 2 consonants.

e is /iy/ elsewhere.

a is /a/ when followed by r + consonant (e.g. art).

a is /æ/ when followed by r + vowel (e.g. arency).

a is /ey/ elsewhere.

i is /I/ when followed by 2 consonants.

i is /ay/ elsewhere.

6. Check the General Rules. Pronounce the word.

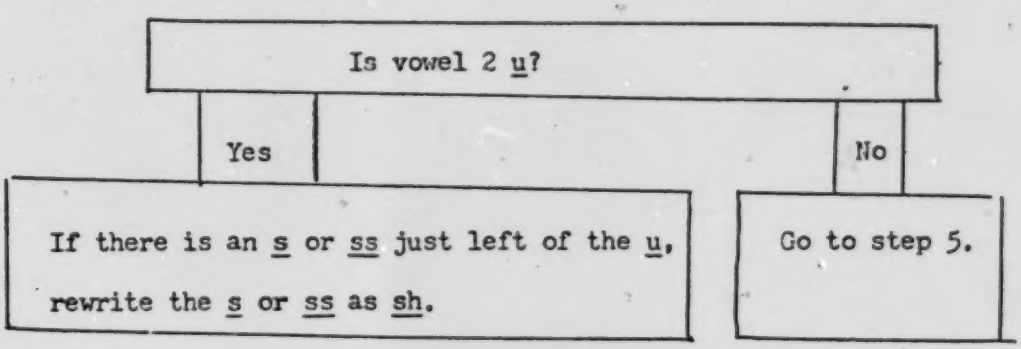
-ancy /ənsiy/, -ance /əns/, -ant /ənt/

1. Number the vowels.

2. If there are 2 consonants immediately to the right of vowel 2, assign stress to vowel 2. If there is a ur sequence just left of vowel 1, assign stress to the u (vowel 2). If there is a y or a w immediately to the left of vowel 1, assign stress to vowel 2. Otherwise assign stress to vowel 3.

3. If ge or gi is immediately to the left of vowel 1, rewrite the ge or gi as j, and go to step 5. Otherwise go to step 4.

4.



5. Perform the Secondary Stress Routine.

6. Vowel pronunciations are only partially predictable, and only by a very complicated set of rules. But consult the General Rules for guidance. Then pronounce the word.

-ic /ɛk/ (Adjectives)

1. Number the vowels; count y as a vowel for vowel 2.
2. Assign stress to vowel 2.
3. Perform Secondary Stress Routine.
4. Pronunciation of vowel 2:

   a: Pronounced as /ey/ if there is no consonant between vowel 1 and vowel 2 or if there is only one consonant and it is s.

   If the a is followed by r + consonant (e.g. art), the a is pronounced as /a/.

   In all other cases, the a is /æ/.

   e: Pronounced as /iy/ if there is no consonant between vowel 1 and vowel 2 or if there is only one consonant and it is s or g.

   If the e is followed by r + consonant (e.g. erg), then it is pronounced as /ɛ/.

   In all other cases, the e is /ɛ̄/.

   o: Pronounced as /ow/ if there is no consonant between vowel 1 and vowel 2, or if there is only one consonant and it is b.

   If there is an r + consonant following the o (e.g. orb), the o is pronounced as /o/.

   Otherwise the o is pronounced as /ɔ/, /a/.

u: i. /ʌ/ if followed by 2 consonants.

ii. Pronounced as /uw/ if there is an r just left of vowel 2, unless step i. applies.

iii. Otherwise the u is pronounced as /yuw/.

i, y : If vowel 2 is i or y (see step 1 above), pronounce vowel 2 as /I/.

5. Pronounce the word.

-ate (Verbs: /eyt/) (Nouns, Adjectives: /ət/)

These words are predictable only when there are at least 3 syllables in the word (i.e. you must be able to number at least 3 vowels in step 2 below).

1. If there is an -ion sequence just left of the suffix, perform the -ion rules (Lesson 1) on the -ion word counting the i as vowel 1, and then go to step 7. Otherwise go to step 2.
2. Number the vowels.
3. Assign stress to vowel 3.
4. If there is a ci or ti sequence just left of the suffix, change the c or t to sh.
5. Rules for vowel 3:

   a: When followed by r + consonant, it is /a/.
   Otherwise it is /æ/.

   i: When followed by a vowel it is /ay/.
   Otherwise it is /I/.

   u: When followed by 2 consonants, it is /ʌ/.
   Otherwise it is /yuw/.

   e: If there is a consonant between vowel 1 and vowel 2, the e is pronounced as /ɛ/.
   If there is no consonant, it is /iy/.

   o: If it is followed by r, it is pronounced as /o/.
   If it is not followed by r, and there is a consonant between vowel 1 and vowel 2, the o is pronounced as /ɔ/, /a/.

If there is no consonant between vowel 1 and vowel 2, it is pronounced as /ow/.

6. Rules for vowel 2:

   If there is a consonant in between vowel 1 and vowel 2, vowel 2 is pronounced as /ə/, unless it is a u.

   When vowel 2 is u, it is pronounced /ə/ before 2 consonants. Otherwise it is /yuw/.

   Otherwise, if there is no consonant between vowel 1 and vowel 2, then vowel 2 is /iy/. If there is an intervening consonant, vowel 2 is /ə/.

7. If the word is a verb, pronounce the suffix as /eyt/. Otherwise it is /ət/.

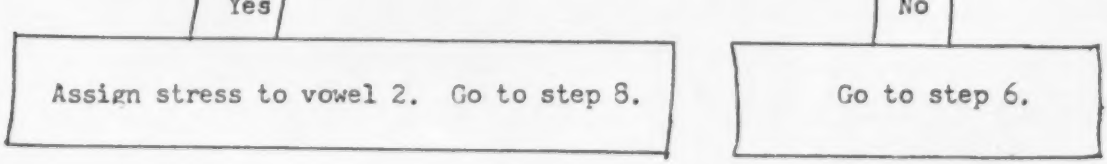
8. Pronounce the word.

-ize, -ise /ayz/ (Verbs)

1. If there is a real English Adjective ending in al just to the left of the suffix, perform the -al rules (Lesson 3), counting the a of -al as vowel 1. Pronounce the -al word normally, adding /ayz/ at the end, and ignore the rules below. Otherwise go to step 2.
2. If there is a real English word ending in an just to the left of the suffix, perform the -an rules (Lesson 4), counting the a of -an as vowel 1. Pronounce the -an word normally, adding /ayz/ at the end, and ignore the rules below. Otherwise go to step 3.
3. Number the vowels.
4. Is there at least one consonant between vowel 2 and vowel 3?
   - Yes → Assign stress to vowel 3.
   - No → Assign stress to vowel 4.
5. Vowels cannot be predicted, but check the General Rules for some guidelines.
6. If there is an s just left of the suffix, it is pronounced /s/.
7. Pronounce the word.

-ism /Izəm/ (Nouns)

1. If there is a real English adjective ending in al just to the left of the suffix -ism, perform the -al rules (lesson 3), counting the a of -al as vowel 1; pronounce the -al word normally, adding /Izəm/ at the end, and ignore the rules below. Otherwise go to step 2.
2. If there is a real English adjective ending in an just to the the left of the suffix -ism, perform the -an rules (Lesson 4), counting the a of -an as vowel 1; pronounce the -an word normally, adding /Izəm/ at the end, and ignore the rules below. Otherwise go to step 3.
3. If there is an actual English word ending in ion just to the left of the suffix -ism, perform the -ion rules (Lesson 1), counting the i of -ion as vowel 1; pronounce the -ion word normally, adding /Izəm/ at the end, and ignore the rules below. Otherwise go to step 4.
4. Number the vowels.
5. Does the sequence morph appear just left of the suffix?



6. Does the sequence 'trop' appear just left of the suffix?

   - Yes → Assign stress to vowel 3. Vowel 2 is /o/. Go to step 8.
   - No → Go to step 7.

7. Is there at least one consonant between vowel 2 and vowel 3?

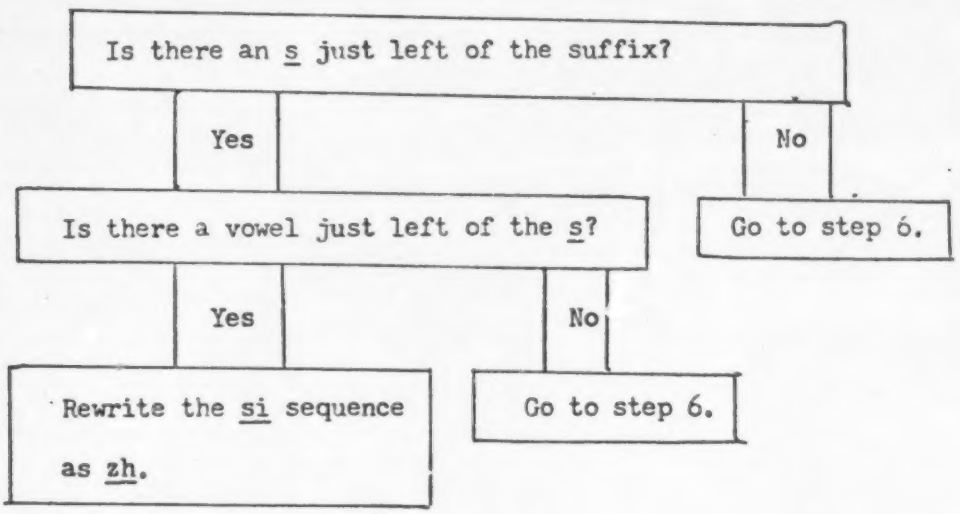
   - Yes → Assign stress to vowel 3.
   - No → Assign stress to vowel 4.

8. Vowels cannot be predicted in general, but check the General Rules for guidelines.

9. Ch just left of the suffix -ism is pronounced /k/.

10. Pronounce the word.

-ia (Nouns)

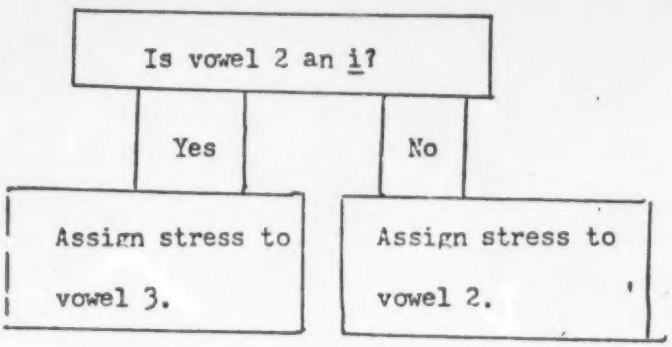
1. Number the vowels.
2. Assign stress to vowel 2. Consult the Special Rules.
3. If there is a c or a t just left of the suffix, rewrite the c or the t plus the following i (ci or ti) as sh.
4. If there is a g just left of the suffix, rewrite the g and the following i (gi) as j.
5. 
Is there an s just left of the suffix?
Yes
No
Is there a vowel just left of the s?
Go to step 6.
Yes
No
Rewrite the si sequence as zh.
Go to step 6.
6. Perform the Secondary Stress Routine. Consult the General Rules. Pronounce the word.

-ible (/əbəl/) (-ibil (/əbíl/) in compounds)

1. Number the vowels.

2. If there are 2 consonants just left of the suffix, assign stress to vowel 2 and go to step 5. Otherwise go to step 3.

3.



4. If stress is on vowel 3, pronounce vowel 3 as follows:

e = /ɛ/

o = /ɔ/, /a/

5. If stress is on vowel 2, pronounce 2 as follows:

i) If vowel 2 is in an r-cluster (i.e. vowel + r + consonant), use the r-cluster rules.

ii) Otherwise:

a = /æ/

e = /ɛ/

i = /ɪ/

o is /ow/ before 1 consonant.

o is /ɔ/, /a/ before 2 consonants.

u is /yuw/ before 1 consonant.

u is /ʌ/ before 2 consonants.

Check the General Rules. Pronounce the word.

-able /ebel/ (Adjectives) (-abil /ebil/ in compounds)

1. Is there an actual English word just left of the suffix?

   - Yes: The suffix is neutral. Pronounce the word to the left of the suffix normally, adding /ebel/ at the end. If there are two pronunciations of the English word to the left of the suffix--one for a verb and one for a noun--choose the verbal form.
   - No: Go to step 2.

2. If you have already performed step 1 twice, go to step 3. If you have performed step 1 only once:

   a) If there is an i just left of the suffix, change it to y (vowel) and go back to step 1.

   b) If there is no i just left of the suffix, place an e just left of the suffix and go back to step 1.

3. If you have added or changed any letters, restore the word to its original spelling. Does the word begin with un or in?

Yes	No
Ignore the un (/ʌn/) or in (/In/) and go to step 1 (still ignoring the un or in); if this is the second time you have performed step 3, go to step 4.	Go to step 4.

4. Number the vowels. Place stress on vowel 3 (vowel 2 if there is no vowel 3 or if vowel 3 is part of initial un or in, which we ignore for stress placement.).

5. Rules for vowels:

   i. If stress is on vowel 2, pronounce vowel 2 as follows:

   a = /æ/

   e = /ɛ/

   o = /ow/

   u is /ʌ/ if followed by 2 consonants;
   otherwise u is /yuw/.

   i is /ay/ if followed by a; otherwise it is /I/.

ii. If stress is on vowel 3, pronounce vowel 3 as follows:

a = /æ/

o = /ɔ/, /a/

e is /ɔ/ if followed by r + consonant (e.g. ert); otherwise e is /ɛ/.

i is /I/ if followed by a consonant; when followed by a vowel it is /ay/.

u is /ʌ/ when followed by 2 consonants. Otherwise it is /yuw/.

6. Pronounce the word.

-age /ejˇ/ (Nouns)

1. Is there an i just left of the suffix?

   - Yes: If there is an r just left of the i, erase the i. Go to step 2.
   - No: Go to step 2.

2. If there is a real English word just left of the suffix, the suffix is neutral; pronounce the word normally, adding -age (/ejˇ/) at the end; otherwise go to step 3.

3. Number the vowels. Assign stress to vowel 2.

4. Rules for pronunciation of vowel 2:

   a: if followed by 2 r's (i.e. arr), it is pronounced /æ/.
   if followed by r + consonant (e.g. arv), it is pronounced /a/. Otherwise it is /æ/.

   e: /ɛ/

   i: /I/

   u: if followed by 2 consonants (e.g. upt), it is pronounced /ʌ/. Otherwise it is /yuw/.

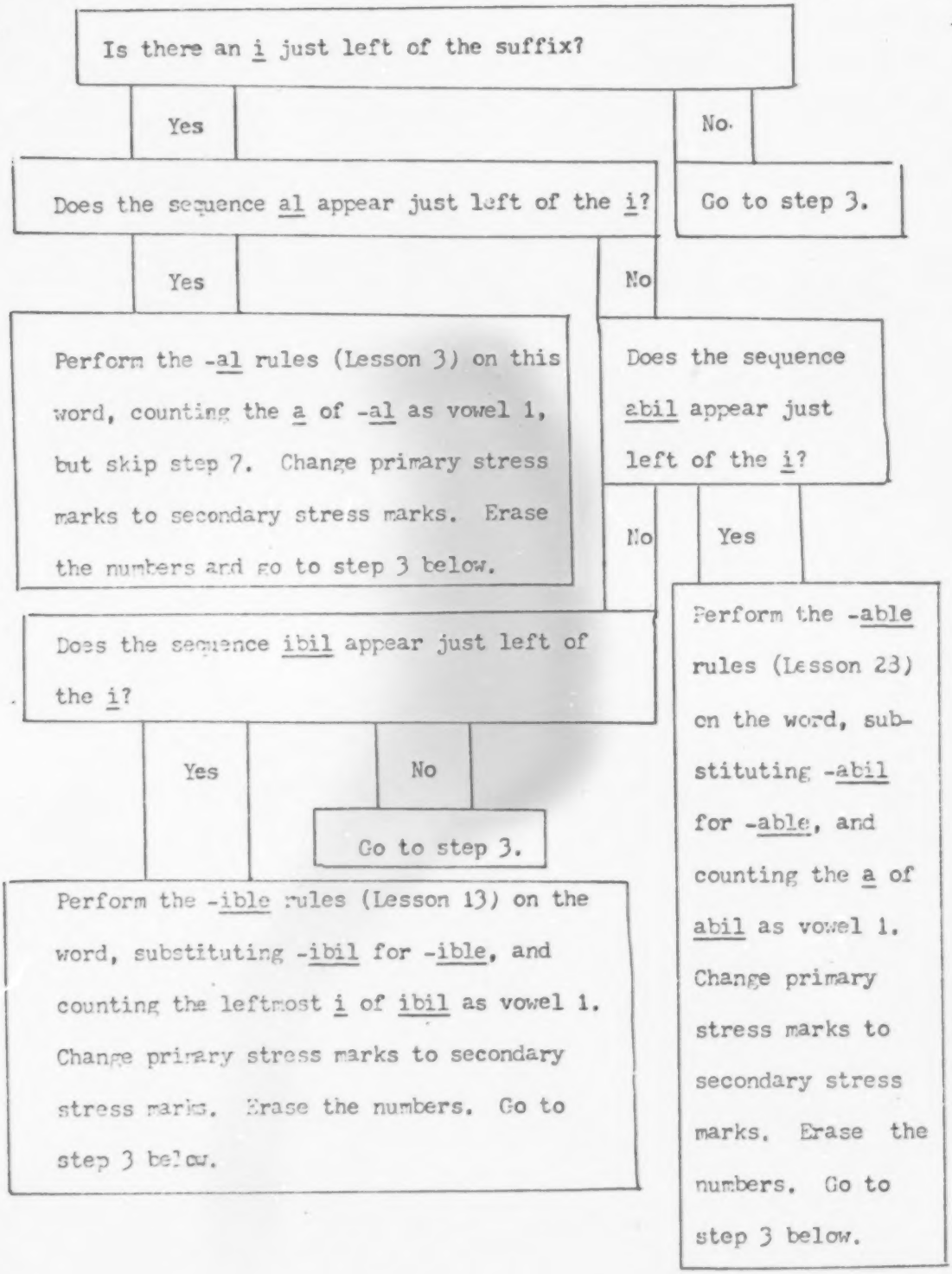
   o: not predictable

5. Pronounce the word.

-ty /tI/, /tiy/ (Nouns)

1. If there is a real English word just to the left of the suffix, then the suffix is neutral, so pronounce the word normally, adding /tiy/ at the end. If there is no such real word, go to step 2.

2.


Is there an i just left of the suffix?
Yes
No
Does the sequence al appear just left of the i?
Go to step 3.
Yes
No
Perform the -al rules (Lesson 3) on this word, counting the a of -al as vowel 1, but skip step 7. Change primary stress marks to secondary stress marks. Erase the numbers and go to step 3 below.
Does the sequence abil appear just left of the i?
No
Yes
Perform the -able rules (Lesson 23) on the word, substituting -abil for -able, and counting the a of abil as vowel 1. Change primary stress marks to secondary stress marks. Erase the numbers. Go to step 3 below.
Does the sequence ibil appear just left of the i?
Yes
No
Go to step 3.
Perform the -ible rules (Lesson 13) on the word, substituting -ibil for -ible, and counting the leftmost i of ibil as vowel 1. Change primary stress marks to secondary stress marks. Erase the numbers. Go to step 3 below.

3. Number the vowels. Place primary stress on vowel 3.

4. Rules for the pronunciation of vowel 3:

   a: if followed by r + consonant (e.g. art), it is pronounced as /a/.
   if followed by a consonant, it is /æ/.
   if followed by a vowel, it is pronounced /ey/.

   e: if followed by r + consonant (e.g. erg), it is pronounced as /ə/.
   if followed by a consonant, it is pronounced /ɛ/.
   if followed by a vowel, it is /iy/.

   i: if followed by r + consonant (e.g. irn), it is pronounced as /ə/.
   if followed by a consonant, it is pronounced /I/.
   if followed by a vowel, it is pronounced as /ay/.

   o: if followed by r, it is pronounced as /o/.
   otherwise it is pronounced as /ɔ/, /a/.

   u: if preceded by r, it is pronounced as /uw/.
   otherwise it is /yuw/.

5. Vowel 2 is pronounced as /ə/.

6. Perform the Secondary Stress Routine if secondary stress has not been assigned.

7. Pronounce the word.

Footnotes

[1] The research involved in developing the rules and testing them on the experimental subjects was supported by a Fulbright-Hays Research Fellowship to L'Université Catholique de Louvain, for which I am grateful. I am indebted to Pierre Godin for his initial interest in the project and for his aid in recruiting subjects. I am grateful to Jacques Van Roey for facilitating my research at the U.C.L. as well as for providing his students as subjects. I am also grateful to Prof. Van Roey as well as Dorothy Deflandre for their initial support of the project. I would like to thank my old friends Brygida and Paul Ostyn-Rudska for helping me in countless practical ways during my stay in Belgium and for their valuable discussions of the methodological and pedagogical implications of the rules. My greatest debt of gratitude is to Lisa Berdann, for helping this research go smoothly in every way possible. Finally, I would like to thank my subjects for their uncommon diligence and patience.

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[2] Chomsky and Halle note, 'It is therefore noteworthy, but not too surprising, that English orthography, despite its often cited

inconsistencies, comes remarkably close to being an optimal orthographic system for English.' (Chomsky and Halle 1968:49)

Sanford Schane has recently discovered many regularities captured by the English spelling system. (Lecture, 1975 Linguistic institute, Tampa, Florida)

[3] Preliminary reports of this research may be found in Schnitzer (1974c, to appear b, 1975a, 1975b, 1976).

[4] The Δ values for the -ate set were also nonsignificant but for a different reason. The majority of errors on these words in the pretest for both the experimental and the control subjects can be ascribed to the fact that none of the subjects knew that the final syllable of English polysyllables in -ate is pronounced as /ət/ in nouns and as /eyt/ in verbs or adjectives.

[5] It should be noted that the rules for -ible (for which the Δ value is significant at the .02 level), have two sets of rules for vowel pronunciation as does the -al set (with a nonsignificant Δ). However, in this case, one of the sets is trivial and could not lead to confusion.

References

Chomsky, Noam and Morris Halle. 1968. The sound pattern of English. New York: Harper and Row.

Crothers, John. 1973. The phonology of aphasia: two reviews. POLA 17: 100-126.

Kehoe, William J. and Harry A. Whitaker. 1973. Lexical structure disruption in aphasia: a case study. Psycholinguistics and aphasia, ed. by Harold Goodglass and Sheila Blumstein, Baltimore: The Johns Hopkins University Press.

Schnitzer, Marc L. 1972. Generative phonology--evidence from aphasia. (Penn State Studies, 34.) University Park, Pennsylvania: The Administrative Committee on Research, The Pennsylvania State University.

_____ 1974a. The psychological reality of the tense-lax distinction for underlying vowels in English. Proceedings of the XIth international congress of linguists, ed. by Luigi Heilmann, 475-488. Pologna: Sociètà editrice il Mulino Bologna.

_____ 1974b. Applied generative phonology: a methodology for teaching pronunciation. IRAL 12:289-305.

_____ 1974c. First report on the efficacy of teaching English pronunciation by rule. Communication and cognition 7: 217-224.

_____ 1975a. Generative spelling: implications for T.E.F.L. Presented at the summer meeting of the linguistic society of

America, July 28-30. Tampa, Florida.

_____ 1975b. Another look at generative spelling: quantitative results. Presented at the winter meeting of the linguistic society of America, December 27-29. San Francisco, California.

_____ 1976. Rule governed pronunciation of English: a case study in generative spelling. ERIC. ED 112 685.

_____ to appear a. The phonology of aphasia: a reply. POLA 18-19 (forthcoming).

_____ to appear b. To appear in Etudes de linguistique comparée: francais-anglais. ed. by Jacques Van Roey.

_____ to appear c. Learning English pronunciation by rule, in preparation.